

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
United States Patent and Trademark  
Office  
Box PCT  
Washington, D.C. 20231  
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

<b>Date of mailing (day/month/year)</b> 12 October 2000 (12.10.00)	
<b>International application No.</b> PCT/IB00/00162	<b>Applicant's or agent's file reference</b> INV0751
<b>International filing date (day/month/year)</b> 16 February 2000 (16.02.00)	<b>Priority date (day/month/year)</b> 16 February 1999 (16.02.99)
<b>Applicant</b> DRECHSEL, Arno	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:  
07 September 2000 (07.09.00)

☐ in a notice effecting later election filed with the International Bureau on:  
\_\_\_\_\_

2. The election ☒ was  
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<b>The International Bureau of WIPO</b> 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	<b>Authorized officer</b> Pascal Piriou Telephone No.: (41-22) 338.83.38
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## PCT COOPERATION TREA

PCT

INFORMATION CONCERNING ELECTED  
OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

From the INTERNATIONAL BUREAU

To:

MAROSCIA, Antonio  
Maroscia & Associati S.  
Corso Palladio, 42  
I-36100 Vicenza  
ITALIERICEVUTO  
OTT 2000  
RECEIVED

Date of mailing (day/month/year) 12 October 2000 (12.10.00)		
Applicant's or agent's file reference INV0751		IMPORTANT INFORMATION
International application No. PCT/IB00/00162	International filing date (day/month/year) 16 February 2000 (16.02.00)	
Applicant DRECHSEL, Arno		Priority date (day/month/year) 16 February 1999 (16.02.99)

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

AP : GH,GM,KE,LS,MW,SD,SL,SZ,TZ,UG,ZW  
 EP : AT,BE,CH,CY,DE,DK,ES,FI,FR,GB,GR,IE,IT,LU,MC,NL,PT,SE  
 National : AU,BG,CA,CN,CZ,DE,IL,JP,KP,KR,MN,NO,NZ,PL,RO,RU,SE,SK,US

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

EA : AM,AZ,BY,KG,KZ,MD,RU,TJ,TM  
 OA : BF,BJ,CF,CG,CI,CM,GA,GN,GW,ML,MR,NE,SN,TD,TG  
 National : AE,AL,AM,AT,AZ,BA,BB,BR,BY,CH,CR,CU,DK,DM,EE,ES,FI,GB,GD,GE,GH,  
 GM,HR,HU,ID,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MW,MX,PT,SD,  
 SG,SI,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW

3. The applicant is reminded that he must enter the "national phase" before the expiration of 30 months from the priority date before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing, if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

The entry into the European regional phase is postponed until 31 months from the priority date for all States designated for the purposes of obtaining a European patent.

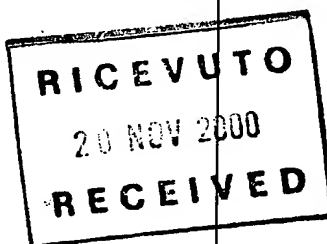
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer: Pascal Piriou Telephone No. (41-22) 338.83.38
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# PATENT COOPERATION TREATY

From the:  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

MAROSCIA, A.  
MAROSCIA & Associati S.r.l.  
CORSO PALLADIO, 42  
I-36100 VICENZA  
ITALIE



PCT

WRITTEN OPINION

(PCT Rule 66)

Applicant's or agent's file reference <b>INV0751</b>		Date of mailing (day/month/year) <b>16.11.2000</b>
International application No. <b>PCT/IB00/00162</b>		International filing date (day/month/year) <b>16/02/2000</b>
		Priority date (day/month/year) <b>16/02/1999</b>
International Patent Classification (IPC) or both national classification and IPC <b>B05B3/04</b>		
Applicant <b>DRECHSEL, Arno</b>		


- This written opinion is the **first** drawn up by this International Preliminary Examining Authority.
- This opinion contains indications relating to the following items:
  - ☒ Basis of the opinion
  - ☐ Priority
  - ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - ☐ Lack of unity of invention
  - ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - ☐ Certain document cited
  - ☒ Certain defects in the international application
  - ☒ Certain observations on the international application
- The applicant is hereby **invited to reply** to this opinion.
 

**When?** See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

**How?** By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

**Also:** For an additional opportunity to submit amendments, see Rule 66.4.  
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.  
For an informal communication with the examiner, see Rule 66.6.

**If no reply is filed,** the international preliminary examination report will be established on the basis of this opinion.
- The final date by which the international preliminary examination report must be established according to Rule 69.2 is: **16/06/2001**.

Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer / Examiner <b>Sbaihi, M</b> Formalities officer (incl. extension of time limits) <b>Murphy-Minehane, B</b> Telephone No. +49 89 2399 2753
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**I. Basis of the opinion**

1. This opinion has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed".*):

**Description, pages:**

1-12 as originally filed

**Claims, No.:**

1-15 as originally filed

**Drawings, sheets:**

1/8-8/8 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-3
Inventive step (IS)	Claims	4-8,12,13,15
Industrial applicability (IA)	Claims	

2. Citations and explanations  
**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**

- D1: DE 577 183 C (LANNINGER) 11 May 1933 (1933-05-11)  
D2: CH 323 524 A (FONDERIE D'ARDON S.A.) 30 September 1957 (1957-09-30)  
D3: US-A-4 231 522 (DRECHSEL) 4 November 1980 (1980-11-04) cited in the application  
D5: DE 561 670 C (PERROT) 29 September 1932 (1932-09-29)  
D6: CH 181 969 A (LANZ) 1 April 1936 (1936-04-01)

**Re Item V**

**Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**Independent claim 1**

Notwithstanding the mentioned lack of clarity (see Item VIII), the subject-matter of independent claim 1 is not new in the sense of Article 33(2) PCT for the following reasons:

The document D3 is regarded as being the closest prior art to the subject-matter of claim 1, and shows (the references in parentheses applying to this document) a self-adjusting rotating joint for an irrigator comprising:

- a first substantially tubular element (consisting of a **lower hollow member 4** fixed to a **flange 2** and an **upper hollow member 8**), adapted to be connected to a liquid feeding inlet pipe (**vertical fixed column 1**),
- a second substantially tubular element (**rotatable tube 10**), adapted to be connected to a liquid distribution nozzle (**The tube 10 carries at its end an interchangeable nozzle**),
- connecting means (**cylindrical member or sleeve 9**) adapted to pivotally connect the first and second elements, so as to allow their reciprocal rotation about a common axis, with limited axial relative displacement, thereby transferring a reaction force produced by the jet,
- braking means (see column 6 lines 27-44) to counter the relative rotary motion of the two tubular elements around the rotation axis. The connecting means consist of a substantially cylindrical tubular element (**sleeve 9**) with substantially constant outer diameter.

Dependent claims

Claim 2 and 3: the additional feature of dependant claim 2 (first tubular element stationary and second tubular element rotating) and claim 3 (connecting tubular element rigidly secured to one of the two tubular elements) are also known from D3 (see column 6 lines 6,7 and lines 17-19);

Claim 4: in claim 4 a slight constructional change in the rotating joint of claim 3 is defined which comes within the scope of the customary practice followed by persons skilled in the art (see for instance D1,D2,D5 or D6), especially as the advantages thus achieved can readily be foreseen. Consequently, the subject-matter of claim 4 lacks an inventive step;

Claim 5: the additional feature of dependant claim 5 (cylindrical tubular connecting means fixedly attached to the second tubular element) is also known from D3 (see column 6 lines 17-21 and fig 3);

Claims 6-8: the additional feature of dependant claims 6-8 are also known from D3 (see fig 3);

Claim 12: the additional feature of dependant claim 12 (antifriction ring) is also known from D3 (sliding bearing 5);

Claims 13 and 15: the additional feature of dependant claims 13 and 15 (pads and elastic means) are also known from D3 (see column 6 lines 27-38 and fig.3).

**Re Item VII**

**Certain defects in the international application**

Following the observations made above and in Item VIII hereafter, the applicant is requested to file a new independant claim; dependent claims should also be redrafted accordingly.

When filing amended claims the applicant should at the same time bring the description into conformity with the amended claims. Care should be taken during revision, especially

of the introductory portion and any statements of problem or advantage, not to add subject-matter which extends beyond the content of the application as originally filed (Article 34.2-b PCT).

Some parts of the description and figures may no more be consistent with the new claims to be filed. They should be deleted. However, if some passages contain relevant technical information, these may be retained; it should then be mentioned that they do not fall within the scope of the claims.

Moreover, the applicant's attention is drawn to the fact that, as a consequence of Rule 66.8(a) PCT the examiner is not permitted to carry out any amendments under the PCT procedure, however minor these may be:

- claim 1: should read "connecting means" instead of connection means";
- page 2 line 30: should read "which is a rather difficult and costly operation";
- page 5 line 23: should read "The lower element";
- page 5 line 28: should read "joined with";
- page 8 line 1: should read "to avoid leakage".

The applicant should also indicate in the letter of reply the difference of the subject-matter of the new claim vis-à-vis the state of the art and the significance thereof.

In order to facilitate the examination of the conformity of the amended application with the requirements of Article 34(2) b) PCT, the applicant is requested to clearly identify the amendments carried out, irrespective of whether they concern amendments by addition, replacement or deletion, and to indicate the passages of the application as filed on which these amendments are based (See also Rule 66.8 a) PCT).

### **Re Item VIII**

#### **Certain observations on the international application**

The term "**lying on a plane passing through said common axis**" used in claim 1 is vague and unclear and leaves the reader in doubt as to the meaning of the technical features to which it refers, thereby rendering the definition of the subject-matter of said claim unclear. It is not clear either whether it refers to the connecting means or to the



reaction force (Article 6 PCT).

The expression used **page 12 last paragraph** is unclear: either the content (partially or entirely) of the cited documents is essential for satisfying the requirements of Art.5 PCT, in which case the relevant content should be incorporated into the description (see Guidelines PCT II-4.17), or it is not essential and then the paragraph should be either deleted or reworded so that it becomes clear that said content is not essential to the requirement under article 5 PCT.



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Patentamt

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P Offic

Directorate General 2

Offic uropéen  
des br vets

Direction Générale 2

## Correspondence with the EPO on PCT Chapter II demands

In order to ensure that your PCT Chapter II demand is dealt with as promptly as possible you are requested to use the enclosed self-adhesive labels with any correspondence relating to the demand sent to the Munich Office.

One of these labels should be affixed to a prominent place in the upper part of the letter or form etc. which you are filing.

# PCT

REC'D 15 MAY 2001

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference INV0751	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/IB00/00162	International filing date (day/month/year) 16/02/2000	Priority date (day/month/year) 16/02/1999
International Patent Classification (IPC) or national classification and IPC B05B3/04		
Applicant DRECHSEL, Arno		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 11 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  07/09/2000	Date of completion of this report  10.05.2001
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Sbahi, M  Telephone No. +49 89 2399 8436 

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/IB00/00162

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*):

**Description, pages:**

1,3,6,7,9,11	as originally filed			
2,4,5,8,10,12	as received on	16/03/2001	with letter of	16/03/2001

**Claims, No.:**

1-13	as received on	16/03/2001	with letter of	16/03/2001
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**Drawings, sheets:**

1/8-4/8,6/8-8/8	as originally filed			
5/8	as received on	16/03/2001	with letter of	16/03/2001

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/IB00/00162

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☒ the claims, Nos.: 14,15  
☐ the drawings, sheets:

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*  
**see separate sheet**

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes:	Claims	1-13
	No:	Claims	
Inventive step (IS)	Yes:	Claims	4,5,7,8,10-13
	No:	Claims	1-3,6,9
Industrial applicability (IA)	Yes:	Claims	1-13
	No:	Claims	

2. Citations and explanations  
**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/IB00/00162

Reference is made to the following documents:

- D1:** CH 323 524 A (FONDERIE D'ARDON S.A.) 30 September 1957 (1957-09-30)  
**D2:** US-A-4 231 522 (DRECHSEL) 4 November 1980 (1980-11-04) cited in the application

**Re Item I**

**Basis of the report**

The independent claim 1 has been amended to clarify or include additional features (Rule 66.3 PCT); the new features are in the characterizing portion of said claim and they are supported by the originally filed claims and description with the exception of the last feature: "said braking means being separate and independent from said tubular connecting element"

Whereas it can be seen from the drawings that braking means are separate from the tubular connecting element (different parts), these two features are not independent to each other (geometry, movement,...), therefore the amendments filed with the letter dated 16/03/2001 introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT.

Examination report has been made without considering this last characteristic.

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**Independent claim 1**

The document D3 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses (cf. figure 3) a self-adjusting rotating joint for an irrigator from which the subject-matter of independent claim 1 differs in that **the tubular connecting element is a section of predetermined length cut from an indefinite pipe having a substantially cylindrical outer surface with no annular flange and braking means being independent from said tubular connecting element.**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/IB00/00162

The problem to be solved can be seen as how to modify the self-adjusting rotating joint of D3 in order to simplify its manufacturing process. One of the most complex part of the joint is the sleeve 9, having functional surfaces to be machined (brake disk surface and contact surface of the sliding bearing 5). It is however a known alternative from the person skilled in the art to provide such a part into two pieces (flange and tube) and fit them together with different known techniques (welding, shrink fitting, moulding, screwing) thereby arriving to a device as claimed in independent claim 1. See for instance such a manufacturing and assembly technique used on the connecting means 3 and its wheel 7 in the device of D2.

Thus, the solution proposed in independent claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT).

Dependent claims

- the feature of dependent claims 2,3 and 6 are known from D3 (see figure 3; col. 6 lines 17-21);
- claim 9 is only the known alternative solution of claim 3 (fixed inner tube with rotatable sleeve // rotatable inner tube with fixed sleeve) obtained by inverting "upper" parts with "lower parts".

rotati n. Such means exert their braking action at various pressure levels of the liquid flowing in the duct. In this manner the effect of the irrigation is improved, and a more uniform and diffused distribution of the liquid on the surface to be sprinkled or on the cultivation to be irrigated is achieved.

5

### Background art

There are known irrigators of the type described above which can support high pressures and are provided with braking means to ensure a sprinkler rotation  
10 as constant and controlled as possible.

US-A-4231522 discloses a stepwise rotating sprinkler provided with a jet deflection system which transmits also the necessary torque to produce jet rotation. In this sprinkler there are also provided braking means ensuring nozzle  
15 rotation at substantially constant angular velocity both when the pressure of the irrigation water is rather elevated, that is at full capacity operation, and when the pressure is comparatively low, for example during the system starting phase, when the liquid feeding pump has not reached the steady state or operates at a reduced pressure for other reasons.

20

In such sprinkler it is necessary to provide for a structural element which has the function of transferring the high forces produced by the jet. This element joins the two parts of the rotating joint moving with relative motion and has both the function of transmitting the torque generated by jet reaction and that  
25 of being an interaction surface for the braking elements.

A first disadvantage of this known sprinkler is that the structural element connecting the two parts of the rotating joint is rather difficult to make because it must be submitted to a rather high number of machining operations  
30 starting from a single piece, which is <sup>a</sup>rather difficult and costly ~~an~~ operation.



drawbacks by providing a selfadjusting rotating joint for liquid distribution, in particular for irrigation, which has a simplified structure, is easy to produce, has high effectiveness and low cost.

- 5 Another object of the invention is to provide a selfadjusting rotating joint with a high flexural stiffness against the jet reaction force.

It is a further object of the invention to provide a lighter joint compared to known sprinkler joints.

10

Another object of the invention is to provide a rotating joint with no need for maintenance during long periods.

- Another object of the present invention is to provide a rotating joint having a simplified structure such as to allow easy assembling and disassembling for spare part substitution and providing high reliability.
- 15

These objects and other that will become apparent hereinafter are achieved by a rotating joint as defined above, <sup>in the attached claim 1.</sup> ~~characterised in that said connection means~~  
~~consist of a substantially cylindrical tubular element with a substantially~~  
~~constant outer diameter.~~

20

#### Brief description of the drawings

- 25 Further characteristics and advantages of the invention will become apparent from the detailed description of some preferred, but non exclusive, embodiments of the rotating joint according to the invention, illustrated by way of a non limitative example by means of the enclosed drawings where:

Fig. 1 shows a partially sectioned perspective view of the rotating joint according to the invention;

30

Fig. 2 shows a longitudinal sectional view taken along an axial plane of the joint of Fig. 1;

Fig. 3 shows a longitudinal sectional view taken along an axial plane of a modified embodiment of the joint of the Fig. 1 and 2;

5 Fig. 4 shows an overall perspective and partially sectioned view of a second embodiment of the rotating joint according to the invention.

Fig. 5 shows a longitudinal sectional view taken along an axial plane of the joint of Fig. 4;

10 Fig. 6 shows a longitudinal sectional view taken along an axial plane of an embodiment of the joint of Fig.4;

Fig. 7 shows a longitudinal sectional view taken along an axial plane of a further embodiment of the rotating joint according to the invention;

Fig. 8 shows a longitudinal section along an axial plane of a further modified embodiment of the joint according to the invention;

15

#### Detailed description of some preferred embodiments

With reference to the cited Figures 1 and 2, the rotating joint, generally indicated with reference numeral 1, is essentially made of two main elements  
20 referenced respectively 2 and 3. A lower element 3 has a substantially tubular shape and is connected to an irrigation liquid feeding duct, not shown in the drawings, by means of a threaded fastener, a flange or other equivalent connecting means. A lower element ~~3~~<sup>5</sup> can be fixed to the ground, to a rigid column or to a self-moving structure.

25

The upper portion of the lower element 3 is connected to the upper element 2, which is likewise of substantially tubular shape. These elements are mutually  
~~joint~~<sup>joined</sup> with suitable connection means, so as to allow relative rotation of the upper element 2 with respect to the lower fixed element 3 around a  
30 substantially vertical axis V, common to both elements.

A first lip gasket 13 is interposed between elements 2, 3 to avoid ~~seepage~~<sup>leakage</sup> between the two elements, which would produce pressure losses with reduction of liquid distribution efficiency. Moreover, as the irrigation liquid is generally mixed with dirt, the infiltration of such dirt between the bearing 8 and the connecting element 6 in the long run causes scratches or notches both on the internal surface of the bearing 8 and on the outer surface of the element 6. This would involve a quicker consumption of the components, with an increase of costs and high seizure risk between the parts in relative movement, with consequent blocking of the rotating part.

In addition to the first gasket 13, a second gasket 14 may be provided to avoid infiltration of liquid, dust cloud, sand or other impurity in the interstices between bearing 8 and pipe 6, neither from the outside nor from the inside of the joint.

Two flat rings 15 and 16 made of material of greater hardness than that of the material of the sleeve 8, preferably stainless steel, are fixed on flange 10. One of the rings, in particular the ring 15 is fixed to the upper surface of the flange 10, the other ring 16 is fixed to the lower surface of the flange 10.

Rings 15 and 16 define contact surfaces for corresponding pads 17 and 18 and constitute with the latter braking means for adjusting the rotation speed of the irrigation nozzle. Pads 17 and 18 operate like normal disk brakes both when the liquid pressure is high and when the pressure is low.

As mentioned above, the upper element 2 can axially shift by a limited distance with respect to the lower element 3, so as to force upward the pad 18 when the water is pressurised, and to act by gravity on the pad 17 when the liquid pressure in the irrigation duct drops to a minimal level.

braking means already shown and disclosed in Fig. 3.

The second arrangement of the braking means, schematically depicted in Fig. 6, corresponds to the arrangement with the braking pads equivalent to that already visible in Fig. 1 and 2, in which the pads 17, 18 are driven in rotation by the upper element 2 of the joint and act against the rings 15, 16 fixedly joined to the upper and lower surfaces of the flange 10.

In the embodiment of the joint according to the invention shown in Fig. 7, elements similar to those of the embodiments already described in the previous figures have been identified with the same reference numerals. In this embodiment, which has a structure similar to that of Fig. 1 and 2, the connecting tubular element ~~5~~<sup>25</sup> is jointly secured to the fixed lower element 3 by suitable securing means.

15

Two rings 28 and 29 having supporting function for the element 2 are placed around the upper rotating element 2. These rings act as friction bearings and for this reason are made of low friction material, for example plastic, with high structural resistance and low friction factor. Such bearings maintain the rotating element 2 in the right position with respect to the fixed element 3 and allow its rotation under the action of the torque produced by the jet of liquid flowing out from the nozzle.

Rings 28, 29 have a substantially L-shaped cross section, with shorter sides 28', 29' and longer sides 28'', 29''. The shorter sides 28', 29' are substantially planar and perpendicular to the rotation axis V and they act as guides for element 2. The longer sides 28'' and 29'' define cylindrical friction surfaces acting against the internal surface of the connecting tubular element 25. Also in this embodiment the gasket 13, for example of the lip type, ensures perfect water tightness of the joint.

30

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elastic means, not shown in the figure and placed in the seats 35, 36.

Pads 31, 32 moreover have internal cylindrical surfaces 31", 32" acting on the external surface of the tubular element 6 to exert on it a reaction to the radial force F produced by the jet of liquid flowing from the nozzle of the irrigator. The distance between the two portions 30" and 30'" is suitably selected in such a manner that the above-mentioned reaction force F produces strong radial stresses that can be borne by a part of the rings 31 and 32. In this embodiment, the tubular connecting element 6 is provided with two connecting rings respectively referenced 37, 38 and axially mutually spaced. The connection rings 37, 38 are secured with any known means, respectively to the upper and lower end portions of the connecting element 6.

Particularly, the upper ring 37 is rigidly secured to the tubular element 6 in correspondence of the upper end portion by means of a metal ring 39 with conical cross section that is adapted to tighten a split ring 40, having a similar conical cross section but with inverted taper. Rings 37 and 38 define respective axial abutments for rings 20 and 21 which provide the braking surfaces.

Although the self-adjusting rotating joint according to the invention has been described with specific reference to the reference numerals indicated in the description and in the figures, it is obvious that such numerals are purely indicative and in no way limit the scope of invention as defined in the appended claims.

~~The contents of Italian patent application No. VI99A000030, for which priority is claimed, are incorporated herein by reference.~~

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NEW CLAIMS

1. Self-adjusting rotating joint (1), particularly for liquid distribution devices, comprising:

- a substantially tubular stationary lower element (3), adapted to be connected to a liquid feeding inlet pipe,

- a substantially tubular rotatable upper element (2), adapted to be connected to a liquid distribution nozzle,

- connecting means (6, 25) adapted to pivotally connect said upper rotatable element (2) and said lower stationary element (3), so as to allow their relative rotation about a common axis (V), with limited axial relative displacement, thereby transferring a reaction force produced by the jet in a plane passing through said common axis (V);

- braking means (10, 15, 16, 17, 18, 20, 21, 22, 23, 30, 31) to counter the relative rotation of said upper and said lower elements (2, 3) about said rotation axis (V);

- said connecting means comprising a substantially cylindrical tubular connecting element (6, 25) with substantially constant outer diameter;

characterised in that said tubular connecting element (6, 25) is a section of predetermined length cut from an indefinite pipe having a substantially cylindrical outer surface with no annular flange, said tubular connecting member (6, 25) being rigidly secured to one of said upper and lower elements (2, 3) with at least part of its substantially cylindrical outer surface, said braking means (10, 15, 16, 17, 18, 20, 21, 22, 23, 30, 31) being separate and independent from said tubular connecting element (6, 25).

2. Self-adjusting rotating joint according to claim 1, characterised in that said tubular connecting element (6, 25) is rotatably coupled to the

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other of said upper and lower elements (2, 3) with the interposition of at least one antifriction annular member (8, 27),

3. Self-adjusting rotating joint according to claim 1, characterised in that said tubular connecting element (6) is fixedly attached to said upper rotatable element (2).

4. Self-adjusting rotating joint according to claim 3, characterised in that a sleeve (9) of substantially cylindrical shape is rigidly attached peripherally of said lower stationary element (3), said sleeve (9) having a flange (10) interacting with said braking means to controllably counter the rotation of said upper rotatable element (2).

5. Self-adjusting rotating joint according to claim 4, characterised in that said braking means comprise pads (17, 18) of material with high wear resistance, adapted to interact with substantially annular braking surfaces (15, 16) unitarily joined to said flange (10).

6. Self-adjusting rotating joint according to claim 3, characterised in that a sleeve (30) of substantially cylindrical shape is rigidly secured to an end portion of said lower stationary element (3) and placed peripherally of said tubular connecting element (6).

7. Self-adjusting rotating joint according to claim 6, characterised in that said sleeve (30) has a substantial cylindrical central portion (30') connected to axial end portions (30'', 30''') adapted to house substantially annular braking pads (30, 31).

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8. Rotating joint according to claim 7, characterised in that said annular braking pads (31, 32) have internal cylindrical surfaces (31", 32"), in friction contact with said tubular connecting element (6) to transfer the reaction to the force (F) exerted by the jet in an axial plane passing through said common axis (V), and planar annular surfaces (31', 32') acting on braking surfaces (20, 21) connected to said upper rotatable element (2) to controllably counter its rotation with respect to said lower stationary element (3).

9. Self-adjusting rotating joint according to claim 1, characterised in that said tubular connecting element (25) is unitarily fixed to said lower stationary element (3).

10. Self-adjusting rotating joint according to claim 9, characterised in that annular members (28, 29) are rigidly fixed to said upper rotatable element (2), said annular members (28, 29) being axially spaced and being interposed between said tubular connection element (25) and said upper rotatable element (2) to define a friction pad and to transmit to said lower stationary element (3) forces acting on said upper rotatable element (2).

11. Self-adjusting rotating joint according to claim 9, characterised in that a sleeve (26) of substantially cylindrical shape is rigidly coupled to said upper rotatable element (2) and is provided with a flange (10) interacting with said braking means (20, 21) to controllably counter the rotation of said rotatable upper element (2).

12. Self-adjusting rotating joint according to claim 9, characterised in that a sleeve (26) of substantially cylindrical shape is rigidly coupled to said upper rotatable element (2) and is provided with a flange (10), said braking



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means consisting of pads (22, 23) unitarily secured to said flange (10) on opposite sides thereof and adapted to interact with braking surfaces (20, 21) defined by substantially annular elements of high wear resistance material.

13. Self-adjusting rotating joint according to any of the claims 5, 7 or 12, characterised in that said pads (17, 18, 22, 23, 31, 32) are shaped as continuous rings or circular sectors circumferentially spaced and placed peripherally of said sleeve (8, 26, 30), elastic means (19, 24) being provided to force said pads (17, 18, 22, 23, 31, 32) against said braking surfaces.



# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

MAROSCIA, A.  
MAROSCIA & Associati S.r.l.  
CORSO PALLADIO, 42  
I-36100 VICENZA  
ITALIE

## PCT

NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT  
(PCT Rule 71.1)

Date of mailing (day/month/year)	10.05.2001
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Applicant's or agent's file reference INV0751	<b>IMPORTANT NOTIFICATION</b>
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International application No. PCT/IB00/00162	International filing date (day/month/year) 16/02/2000	Priority date (day/month/year) 16/02/1999
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Applicant  
DRECHSEL, Arno

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

#### 4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
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## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>INV0751</b>		<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. <b>PCT/IB00/00162</b>	International filing date (day/month/year) <b>16/02/2000</b>	Priority date (day/month/year) <b>16/02/1999</b>	
International Patent Classification (IPC) or national classification and IPC <b>B05B3/04</b>			
Applicant <b>DRECHSEL, Arno</b>			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 11 sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the report</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input type="checkbox"/> Certain defects in the international application</li> <li>VIII <input type="checkbox"/> Certain observations on the international application</li> </ul>			
Date of submission of the demand  <b>07/09/2000</b>		Date of completion of this report  <b>10.05.2001</b>	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized officer  <b>Sbaihi, M</b>  Telephone No. +49 89 2399 8436	



# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB00/00162

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17):*

### Description, pages:

1,3,6,7,9,11	as originally filed			
2,4,5,8,10,12	as received on	16/03/2001	with letter of	16/03/2001

### Claims, No.:

1-13	as received on	16/03/2001	with letter of	16/03/2001
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### Drawings, sheets:

1/8-4/8,6/8-8/8	as originally filed			
5/8	as received on	16/03/2001	with letter of	16/03/2001

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/IB00/00162

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☒ the claims, Nos.: 14,15  
☐ the drawings, sheets:

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

**see separate sheet**

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes:	Claims	1-13
	No:	Claims	
Inventive step (IS)	Yes:	Claims	4,5,7,8,10-13
	No:	Claims	1-3,6,9
Industrial applicability (IA)	Yes:	Claims	1-13
	No:	Claims	

2. Citations and explanations

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/IB00/00162

Reference is made to the following documents:

- D1: CH 323 524 A (FONDERIE D'ARDON S.A.) 30 September 1957 (1957-09-30)  
D2: US-A-4 231 522 (DRECHSEL) 4 November 1980 (1980-11-04) cited in the application

**Re Item I**

**Basis of the report**

The independent claim 1 has been amended to clarify or include additional features (Rule 66.3 PCT); the new features are in the characterizing portion of said claim and they are supported by the originally filed claims and description with the exception of the last feature: "said braking means being separate and independent from said tubular connecting element"

Whereas it can be seen from the drawings that braking means are separate from the tubular connecting element (different parts), these two features are not independent to each other (geometry, movement,...), therefore the amendments filed with the letter dated 16/03/2001 introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT.

Examination report has been made without considering this last characteristic.

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**Independent claim 1**

The document D3 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses (cf. figure 3) a self-adjusting rotating joint for an irrigator from which the subject-matter of independent claim 1 differs in that **the tubular connecting element is a section of predetermined length cut from an indefinite pipe having a substantially cylindrical outer surface with no annular flange and braking means being independent from said tubular connecting element.**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/IB00/00162

The problem to be solved can be seen as how to modify the self-adjusting rotating joint of D3 in order to simplify its manufacturing process. One of the most complex part of the joint is the sleeve 9, having functional surfaces to be machined (brake disk surface and contact surface of the sliding bearing 5). It is however a known alternative from the person skilled in the art to provide such a part into two pieces (flange and tube) and fit them together with different known techniques (welding, shrink fitting, moulding, screwing) thereby arriving to a device as claimed in independent claim 1. See for instance such a manufacturing and assembly technique used on the connecting means 3 and its wheel 7 in the device of D2.

Thus, the solution proposed in independent claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT).

Dependent claims

- the feature of dependent claims 2,3 and 6 are known from D3 (see figure 3; col. 6 lines 17-21);
- claim 9 is only the known alternative solution of claim 3 (fixed inner tube with rotatable sleeve // rotatable inner tube with fixed sleeve) obtained by inverting "upper" parts with "lower parts".



rotation. Such means exert their braking action at various pressure levels of the liquid flowing in the duct. In this manner the effect of the irrigation is improved, and a more uniform and diffused distribution of the liquid on the surface to be sprinkled or on the cultivation to be irrigated is achieved.

5

### Background art

There are known irrigators of the type described above which can support high pressures and are provided with braking means to ensure a sprinkler rotation  
10 as constant and controlled as possible.

US-A-4231522 discloses a stepwise rotating sprinkler provided with a jet deflection system which transmits also the necessary torque to produce jet rotation. In this sprinkler there are also provided braking means ensuring nozzle  
15 rotation at substantially constant angular velocity both when the pressure of the irrigation water is rather elevated, that is at full capacity operation, and when the pressure is comparatively low, for example during the system starting phase, when the liquid feeding pump has not reached the steady state or operates at a reduced pressure for other reasons.

20

In such sprinkler it is necessary to provide for a structural element which has the function of transferring the high forces produced by the jet. This element joins the two parts of the rotating joint moving with relative motion and has both the function of transmitting the torque generated by jet reaction and that  
25 of being an interaction surface for the braking elements.

A first disadvantage of this known sprinkler is that the structural element connecting the two parts of the rotating joint is rather difficult to make because it must be submitted to a rather high number of machining operations  
30 starting from a single piece, which is <sup>2</sup>rather difficult and costly ~~an~~ operation.

drawbacks by providing a selfadjusting rotating joint for liquid distribution, in particular for irrigation, which has a simplified structure, is easy to produce, has high effectiveness and low cost.

- 5 Another object of the invention is to provide a selfadjusting rotating joint with a high flexural stiffness against the jet reaction force.

It is a further object of the invention to provide a lighter joint compared to known sprinkler joints.

10

Another object of the invention is to provide a rotating joint with no need for maintenance during long periods.

- 15 Another object of the present invention is to provide a rotating joint having a simplified structure such as to allow easy assembling and disassembling for spare part substitution and providing high reliability.

These objects and other that will become apparent hereinafter are achieved by a rotating joint as defined above, <sup>in the attached claim 1.</sup> ~~characterised in that said connection means~~  
20 ~~consist of a substantially cylindrical tubular element with a substantially~~  
~~constant outer diameter.~~

#### Brief description of the drawings

- 25 Further characteristics and advantages of the invention will become apparent from the detailed description of some preferred, but non exclusive, embodiments of the rotating joint according to the invention, illustrated by way of a non limitative example by means of the enclosed drawings where:

Fig. 1 shows a partially sectioned perspective view of the rotating joint  
30 according to the invention;

Fig. 2 shows a longitudinal sectional view taken along an axial plane of the joint of Fig. 1;

Fig. 3 shows a longitudinal sectional view taken along an axial plane of a modified embodiment of the joint of the Fig. 1 and 2;

5 Fig. 4 shows an overall perspective and partially sectioned view of a second embodiment of the rotating joint according to the invention.

Fig. 5 shows a longitudinal sectional view taken along an axial plane of the joint of Fig. 4;

10 Fig. 6 shows a longitudinal sectional view taken along an axial plane of an embodiment of the joint of Fig.4;

Fig. 7 shows a longitudinal sectional view taken along an axial plane of a further embodiment of the rotating joint according to the invention;

Fig. 8 shows a longitudinal section along an axial plane of a further modified embodiment of the joint according to the invention;

15

#### Detailed description of some preferred embodiments

With reference to the cited Figures 1 and 2, the rotating joint, generally indicated with reference numeral 1, is essentially made of two main elements  
20 referenced respectively 2 and 3. A lower element 3 has a substantially tubular shape and is connected to an irrigation liquid feeding duct, not shown in the drawings, by means of a threaded fastener, a flange or other equivalent connecting means. A lower element ~~3~~<sup>5</sup> can be fixed to the ground, to a rigid column or to a self-moving structure.

25

The upper portion of the lower element 3 is connected to the upper element 2, which is likewise of substantially tubular shape. These elements are mutually  
~~joint~~<sup>joined</sup> with suitable connection means, so as to allow relative rotation of the upper element 2 with respect to the lower fixed element 3 around a  
30 substantially vertical axis V, common to both elements.

A first lip gasket 13 is interposed between elements 2, 3 to avoid ~~seepage~~<sup>leakage</sup> between the two elements, which would produce pressure losses with reduction of liquid distribution efficiency. Moreover, as the irrigation liquid is generally mixed with dirt, the infiltration of such dirt between the bearing 8 and the connecting element 6 in the long run causes scratches or notches both on the internal surface of the bearing 8 and on the outer surface of the element 6. This would involve a quicker consumption of the components, with an increase of costs and high seizure risk between the parts in relative movement, with consequent blocking of the rotating part.

10

In addition to the first gasket 13, a second gasket 14 may be provided to avoid infiltration of liquid, dust cloud, sand or other impurity in the interstices between bearing 8 and pipe 6, neither from the outside nor from the inside of the joint.

15

Two flat rings 15 and 16 made of material of greater hardness than that of the material of the sleeve 8, preferably stainless steel, are fixed on flange 10. One of the rings, in particular the ring 15 is fixed to the upper surface of the flange 10, the other ring 16 is fixed to the lower surface of the flange 10.

20

Rings 15 and 16 define contact surfaces for corresponding pads 17 and 18 and constitute with the latter braking means for adjusting the rotation speed of the irrigation nozzle. Pads 17 and 18 operate like normal disk brakes both when the liquid pressure is high and when the pressure is low.

25

As mentioned above, the upper element 2 can axially shift by a limited distance with respect to the lower element 3, so as to force upward the pad 18 when the water is pressurised, and to act by gravity on the pad 17 when the liquid pressure in the irrigation duct drops to a minimal level.

30

braking means already shown and disclosed in Fig. 3.

The second arrangement of the braking means, schematically depicted in Fig. 6, corresponds to the arrangement with the braking pads equivalent to that already visible in Fig. 1 and 2, in which the pads 17, 18 are driven in rotation by the upper element 2 of the joint and act against the rings 15, 16 fixedly joined to the upper and lower surfaces of the flange 10.

In the embodiment of the joint according to the invention shown in Fig. 7, elements similar to those of the embodiments already described in the previous figures have been identified with the same reference numerals. In this embodiment, which has a structure similar to that of Fig. 1 and 2, the connecting tubular element ~~5~~<sup>25</sup> is jointly secured to the fixed lower element 3 by suitable securing means.

Two rings 28 and 29 having supporting function for the element 2 are placed around the upper rotating element 2. These rings act as friction bearings and for this reason are made of low friction material, for example plastic, with high structural resistance and low friction factor. Such bearings maintain the rotating element 2 in the right position with respect to the fixed element 3 and allow its rotation under the action of the torque produced by the jet of liquid flowing out from the nozzle.

Rings 28, 29 have a substantially L-shaped cross section, with shorter sides 28', 29' and longer sides 28'', 29''. The shorter sides 28', 29' are substantially planar and perpendicular to the rotation axis V and they act as guides for element 2. The longer sides 28'' and 29'' define cylindrical friction surfaces acting against the internal surface of the connecting tubular element 25. Also in this embodiment the gasket 13, for example of the lip type, ensures perfect water tightness of the joint.

elastic means, not shown in the figure and placed in the seats 35, 36.

Pads 31, 32 moreover have internal cylindrical surfaces 31", 32" acting on the external surface of the tubular element 6 to exert on it a reaction to the radial  
5 force F produced by the jet of liquid flowing from the nozzle of the irrigator. The distance between the two portions 30" and 30'" is suitably selected in such a manner that the above-mentioned reaction force F produces strong radial stresses that can be borne by a part of the rings 31 and 32. In this embodiment, the tubular connecting element 6 is provided with two  
10 connecting rings respectively referenced 37, 38 and axially mutually spaced. The connection rings 37, 38 are secured with any known means, respectively to the upper and lower end portions of the connecting element 6.

Particularly, the upper ring 37 is rigidly secured to the tubular element 6 in  
15 correspondence of the upper end portion by means of a metal ring 39 with conical cross section that is adapted to tighten a split ring 40, having a similar conical cross section but with inverted taper. Rings 37 and 38 define respective axial abutments for rings 20 and 21 which provide the braking surfaces.

20 Although the self-adjusting rotating joint according to the invention has been described with specific reference to the reference numerals indicated in the description and in the figures, it is obvious that such numerals are purely indicative and in no way limit the scope of invention as defined in the  
25 appended claims.

~~The contents of Italian patent application No. V199A000030, for which priority is claimed, are incorporated herein by reference.~~

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NEW CLAIMS

1. Self-adjusting rotating joint (1), particularly for liquid distribution devices, comprising:

- a substantially tubular stationary lower element (3), adapted to be connected to a liquid feeding inlet pipe,

- a substantially tubular rotatable upper element (2), adapted to be connected to a liquid distribution nozzle,

- connecting means (6, 25) adapted to pivotally connect said upper rotatable element (2) and said lower stationary element (3), so as to allow their relative rotation about a common axis (V), with limited axial relative displacement, thereby transferring a reaction force produced by the jet in a plane passing through said common axis (V);

- braking means (10, 15, 16, 17, 18, 20, 21, 22, 23, 30, 31) to counter the relative rotation of said upper and said lower elements (2, 3) about said rotation axis (V);

- said connecting means comprising a substantially cylindrical tubular connecting element (6, 25) with substantially constant outer diameter;

characterised in that said tubular connecting element (6, 25) is a section of predetermined length cut from an indefinite pipe having a substantially cylindrical outer surface with no annular flange, said tubular connecting member (6, 25) being rigidly secured to one of said upper and lower elements (2, 3) with at least part of its substantially cylindrical outer surface, said braking means (10, 15, 16, 17, 18, 20, 21, 22, 23, 30, 31) being separate and independent from said tubular connecting element (6, 25).

2. Self-adjusting rotating joint according to claim 1, characterised in that said tubular connecting element (6, 25) is rotatably coupled to the

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other of said upper and lower elements (2, 3) with the interposition of at least one antifriction annular member (8, 27),

3. Self-adjusting rotating joint according to claim 1, characterised in that said tubular connecting element (6) is fixedly attached to said upper rotatable element (2).

4. Self-adjusting rotating joint according to claim 3, characterised in that a sleeve (9) of substantially cylindrical shape is rigidly attached peripherally of said lower stationary element (3), said sleeve (9) having a flange (10) interacting with said braking means to controllably counter the rotation of said upper rotatable element (2).

5. Self-adjusting rotating joint according to claim 4, characterised in that said braking means comprise pads (17, 18) of material with high wear resistance, adapted to interact with substantially annular braking surfaces (15, 16) unitarily joined to said flange (10).

6. Self-adjusting rotating joint according to claim 3, characterised in that a sleeve (30) of substantially cylindrical shape is rigidly secured to an end portion of said lower stationary element (3) and placed peripherally of said tubular connecting element (6).

7. Self-adjusting rotating joint according to claim 6, characterised in that said sleeve (30) has a substantial cylindrical central portion (30') connected to axial end portions (30'', 30''') adapted to house substantially annular braking pads (30, 31).



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8. Rotating joint according to claim 7, characterised in that said annular braking pads (31, 32) have internal cylindrical surfaces (31", 32"), in friction contact with said tubular connecting element (6) to transfer the reaction to the force (F) exerted by the jet in an axial plane passing through said common axis (V), and planar annular surfaces (31', 32') acting on braking surfaces (20, 21) connected to said upper rotatable element (2) to controllably counter its rotation with respect to said lower stationary element (3).

9. Self-adjusting rotating joint according to claim 1, characterised in that said tubular connecting element (25) is unitarily fixed to said lower stationary element (3).

10. Self-adjusting rotating joint according to claim 9, characterised in that annular members (28, 29) are rigidly fixed to said upper rotatable element (2), said annular members (28, 29) being axially spaced and being interposed between said tubular connection element (25) and said upper rotatable element (2) to define a friction pad and to transmit to said lower stationary element (3) forces acting on said upper rotatable element (2).

11. Self-adjusting rotating joint according to claim 9, characterised in that a sleeve (26) of substantially cylindrical shape is rigidly coupled to said upper rotatable element (2) and is provided with a flange (10) interacting with said braking means (20, 21) to controllably counter the rotation of said rotatable upper element (2).

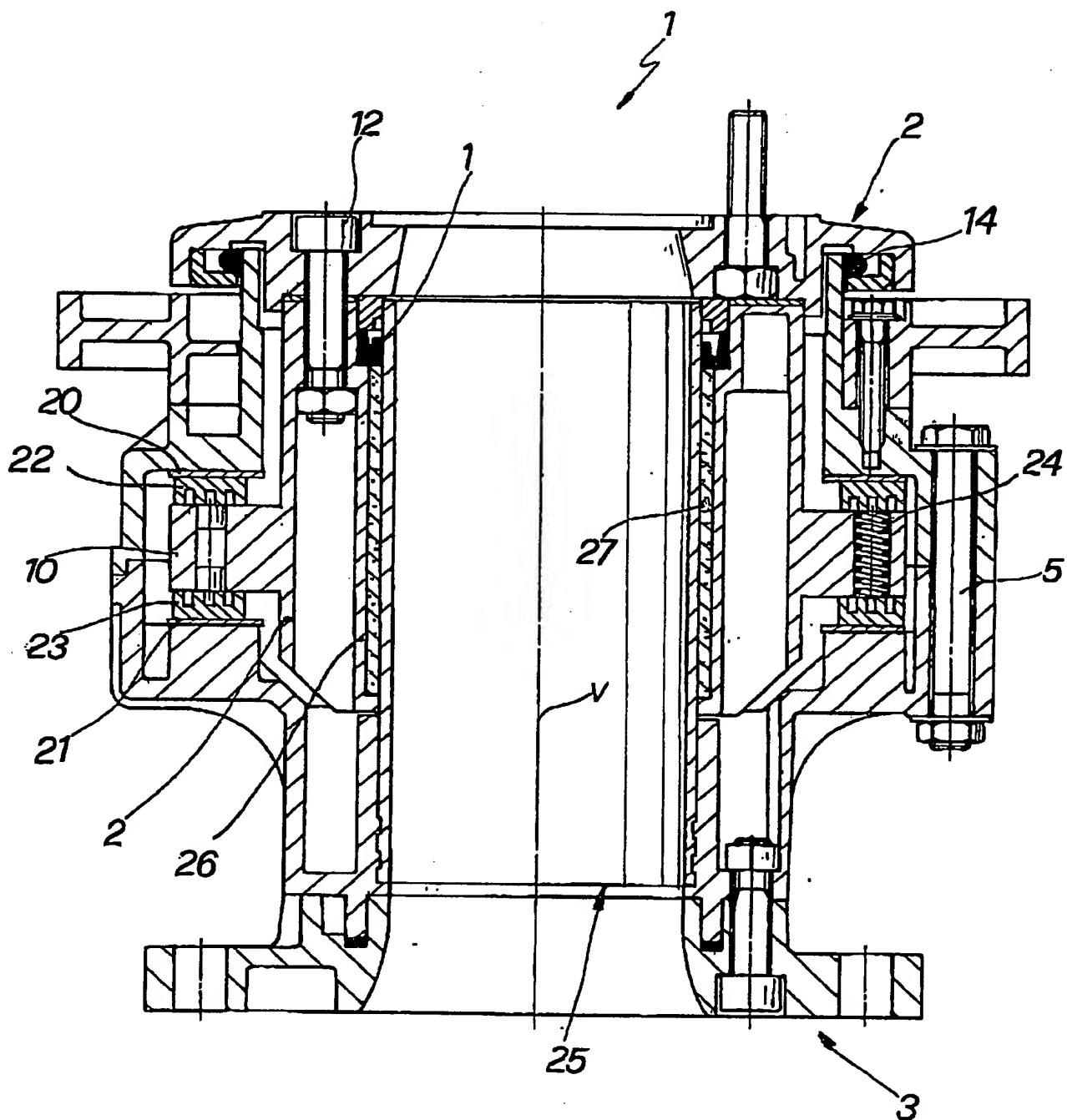
12. Self-adjusting rotating joint according to claim 9, characterised in that a sleeve (26) of substantially cylindrical shape is rigidly coupled to said upper rotatable element (2) and is provided with a flange (10), said braking

INV0751

means consisting of pads (22, 23) unitarily secured to said flange (10) on opposite sides thereof and adapted to interact with braking surfaces (20, 21) defined by substantially annular elements of high wear resistance material.

13. Self-adjusting rotating joint according to any of the claims 5, 7 or 12, characterised in that said pads (17, 18, 22, 23, 31, 32) are shaped as continuous rings or circular sectors circumferentially spaced and placed peripherally of said sleeve (8, 26, 30), elastic means (19, 24) being provided to force said pads (17, 18, 22, 23, 31, 32) against said braking surfaces.

5/8

**Fig. 5**

## TENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

**PCT**NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL SEARCH REPORT  
OR THE DECLARATION

(PCT Rule 44.1)

To:

MAROSCIA & Associati S.r.l.  
Attn. MAROSCIA, A.  
CORSO PALLADIO, 42  
I-36100 VICENZA  
ITALY**RICEVUTO**

- 3 LUG 2000

**RECEIVED**Date of mailing  
(day/month/year)

29/06/2000

Applicant's or agent's file reference

INV0751

**FOR FURTHER ACTION**

See paragraphs 1 and 4 below

International application No.

PCT/IB 00/00162

International filing date  
(day/month/year)

16/02/2000

Applicant

DRECHSEL, Arno

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

**Filing of amendments and statement under Article 19:**

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

**When?** The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

**Where?** Directly to the International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland  
Fascimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within **19 months** from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within **20 months** from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2  
NL-2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Irene Rbia-Brand

## TENT COOPERATION TREAT

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>INV0751</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/IB 00/ 00162</b>	International filing date (day/month/year) <b>16/02/2000</b>	(Earliest) Priority Date (day/month/year) <b>16/02/1999</b>
Applicant <b>DRECHSEL, Arno</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of Invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☒ because this figure better characterizes the invention.

3

☐ None of the figures.

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

## INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

### What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

### When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

### Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

### How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

### What documents must/may accompany the amendments?

#### Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

## INTERNATIONAL SEARCH REPORT

National Application No

/IB 00/00162

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B05B3/04 B05B3/16 A01G25/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B05B A01G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 577 183 C (LANNINGER) 11 May 1933 (1933-05-11)	1-5
Y	the whole document	6-8, 10-15
X	CH 323 524 A (FONDERIE D'ARDON S.A.) 30 September 1957 (1957-09-30)	1,2
A	page 1, column D, line 40 - line 43; figure 1	3-5,9
Y	US 4 231 522 A (DRECHSEL) 4 November 1980 (1980-11-04) cited in the application claims; figures	6-8, 10-15
	--- -/--	

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&amp;" document member of the same patent family

Date of the actual completion of the international search

20 June 2000

Date of mailing of the international search report

29/06/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentaan 2  
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Fax: (+31-70) 340-3016

Authorized officer

Fonts Cavestany, A

## INTERNATIONAL SEARCH REPORT

International Application No

/IB 00/00162

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 630 689 A (DRECHSEL ARNO) 28 December 1994 (1994-12-28) cited in the application column 3, line 39 -column 5, line 33; figures ----	6-8, 11-15
A	DE 561 670 C (PERROT) 29 September 1932 (1932-09-29) the whole document ----	1-5, 9
A	CH 181 969 A (LANZ) 1 April 1936 (1936-04-01) the whole document ----	1-15
A	US 3 744 720 A (MEYER L) 10 July 1973 (1973-07-10) claims; figures -----	10-15



The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:  
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:  
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:  
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or  
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:  
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

**"Statement under article 19(1)" (Rule 46.4)**

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

**It must be in the language in which the international application is to be published.**

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

**Consequence if a demand for international preliminary examination has already been filed**

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

**Consequence with regard to translation of the international application for entry into the national phase**

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>7</sup> :

B05B 3/04, 3/16, A01G 25/00

A1

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(30) Priority Data:

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IT

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(74) Agent: MAROSCIA, Antonio; Maroscia &amp; Associati S.r.l., Corso Palladio, 42, I-36100 Vicenza (IT).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

## Published

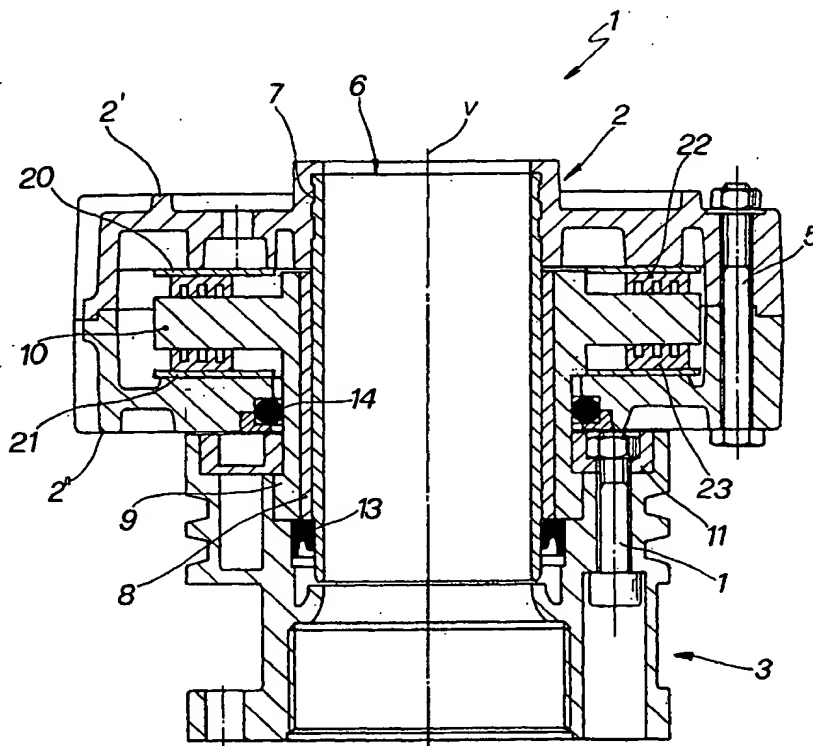
With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: SELF-ADJUSTING ROTATING JOINT, ESPECIALLY FOR LIQUID DISTRIBUTION DEVICES

## (57) Abstract

A self-adjusting rotating joint (1), especially for liquid distribution devices, including a first substantially tubular element (3), adapted to be connected to a liquid feeding inlet pipe, a second substantially tubular element (2), adapted to be connected to a liquid distribution nozzle, connecting means (6, 25) adapted to connect pivotally first (3) and second element (2), so as to allow their reciprocal rotation around a common axis (V), with limited axial relative displacement, transmitting a reaction force generated by the jet and lying on a plane passing through said common axis (V), braking means (15, 16, 17, 18, 20, 21, 22, 23, 30, 31) to counter the relative rotary motion of the element (2,3) about the rotation axis (V). The rotating joint is characterised in that the connecting means are made of a substantially cylindrical tubular element (6, 25) with substantially constant outer diameter.



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# SELF-ADJUSTING ROTATING JOINT, ESPECIALLY FOR LIQUID DISTRIBUTION DEVICES

## Technical Field

5

The present invention relates to a self-adjusting rotating joint, particularly for distribution devices of liquids under pressure, of the pulse sprinkler or similar type, with all the features mentioned in the preamble of the main claim.

- 10 The rotating irrigators of the above mentioned type, with continuous or discontinuous operation, can be used in agriculture, for example to irrigate crops or surfaces of various dimensions, or in industry, for dust cloud laying or to humidify, cool down or treat material extracted from mines. Depending on the use, liquids distributed can be of various types, for example pure water,
- 15 sea water, saline or acid solutions.

Such irrigators may have large dimensions and may be mounted on mobile or fixed irrigation systems. The pressurised liquid is distributed through a nozzle which is connected to the feeding duct of the liquid by means of a rotating

20 joint. Such joint comprises bearings allowing the nozzle to pivot on a full circumference about the axis of the joint, or for a circular sector if the plant or irrigation system so requires, to have the most uniform distribution of the liquid or to avoid spraying of buildings, roads, persons or other kind of obstacles.

25

On the body of the nozzle, means are provided to crush the jet and to move the nozzle with continuous or stepwise rotation. Because of the strong forces generated by the jet reaction, such joints must be able to transfer high torque. Moreover, to prevent an uncontrolled rotation of the nozzle, the joint is

30 provided with appropriate brake means to resist the moment causing nozzle

rotation. Such means exert their braking action at various pressure levels of the liquid flowing in the duct. In this manner the effect of the irrigation is improved, and a more uniform and diffused distribution of the liquid on the surface to be sprinkled or on the cultivation to be irrigated is achieved.

5

### Background art

There are known irrigators of the type described above which can support high pressures and are provided with braking means to ensure a sprinkler rotation  
10 as constant and controlled as possible.

US-A-4231522 discloses a stepwise rotating sprinkler provided with a jet deflection system which transmits also the necessary torque to produce jet rotation. In this sprinkler there are also provided braking means ensuring nozzle  
15 rotation at substantially constant angular velocity both when the pressure of the irrigation water is rather elevated, that is at full capacity operation, and when the pressure is comparatively low, for example during the system starting phase, when the liquid feeding pump has not reached the steady state or operates at a reduced pressure for other reasons.

20

In such sprinkler it is necessary to provide for a structural element which has the function of transferring the high forces produced by the jet. This element joins the two parts of the rotating joint moving with relative motion and has both the function of transmitting the torque generated by jet reaction and that  
25 of being an interaction surface for the braking elements.

A first disadvantage of this known sprinkler is that the structural element connecting the two parts of the rotating joint is rather difficult to make because it must be submitted to a rather high number of machining operations  
30 starting from a single piece, which is rather difficult and costly an operation.

Moreover the complex shape of this piece is such as to cause an excessive scrap of material during the manufacture. In addition, since such element must be water tight in the contact zone with the packing and the bearing placed around it, it must have an accurate surface finish. Generally such pieces  
5 require very fine and accurate working of the surface with a machine tool and subsequently their surface must be hardened or chrome-plated to guarantee maximum resistance against oxidation and abrasive action of the liquid.

In the sealing zone between bearing and tubular element, it is necessary to  
10 provide for as small as possible a clearance between the moving parts to guarantee a perfect water tightness of the lip seal, as liquid leakage can produce in the long run oxidation, or even corrosion in other elements of the joint hampering correct operation thereof. The liquid to be sprayed generally contains many impurities that can sometimes seep in the contact zones  
15 between the two elements which rotate relatively to each other and can damage the surface of the bearing and that of the chrome-plated metal element.

It has also been proposed to use sprinklers with rotating joints characterised  
20 by high mechanical resistance to counter the torque acting on the joint itself when the sprinkler is in operation. A solution of this kind is described in EP-B-630689 disclosing a rotating joint for sprinkler, provided with braking means and with high flexural resistance to bending caused by jet reaction. However such joint presents a remarkable complexity, as the various parts  
25 from which it is formed have complex shapes and are thus expensive to manufacture.

### Summary of the invention

30 It is an object of the present invention to overcome the above mentioned

drawbacks by providing a self-adjusting rotating joint for liquid distribution, in particular for irrigation, which has a simplified structure, is easy to produce, has high effectiveness and low cost.

- 5 Another object of the invention is to provide a self-adjusting rotating joint with a high flexural stiffness against the jet reaction force.

It is a further object of the invention to provide a lighter joint compared to known sprinkler joints.

10

Another object of the invention is to provide a rotating joint with no need for maintenance during long periods.

- 15 Another object of the present invention is to provide a rotating joint having a simplified structure such as to allow easy assembling and disassembling for spare part substitution and providing high reliability.

- 20 These objects and other that will become apparent hereinafter are achieved by a rotating joint as defined above, characterised in that said connection means consist of a substantially cylindrical tubular element with a substantially constant outer diameter.

### Brief description of the drawings

- 25 Further characteristics and advantages of the invention will become apparent from the detailed description of some preferred, but non exclusive, embodiments of the rotating joint according to the invention, illustrated by way of a non limitative example by means of the enclosed drawings where:

- 30 Fig. 1 shows a partially sectioned perspective view of the rotating joint according to the invention;

Fig. 2 shows a longitudinal sectional view taken along an axial plane of the joint of Fig. 1;

Fig. 3 shows a longitudinal sectional view taken along an axial plane of a modified embodiment of the joint of the Fig. 1 and 2;

5 Fig. 4 shows an overall perspective and partially sectioned view of a second embodiment of the rotating joint according to the invention.

Fig. 5 shows a longitudinal sectional view taken along an axial plane of the joint of Fig. 4;

10 Fig. 6 shows a longitudinal sectional view taken along an axial plane of an embodiment of the joint of Fig.4;

Fig. 7 shows a longitudinal sectional view taken along an axial plane of a further embodiment of the rotating joint according to the invention;

Fig. 8 shows a longitudinal section along an axial plane of a further modified embodiment of the joint according to the invention;

15

#### Detailed description of some preferred embodiments

With reference to the cited Figures 1 and 2, the rotating joint, generally indicated with reference numeral 1, is essentially made of two main elements  
20 referenced respectively 2 and 3. A lower element 3 has a substantially tubular shape and is connected to an irrigation liquid feeding duct, not shown in the drawings, by means of a threaded fastener, a flange or other equivalent connecting means. A lower element 3 can be fixed to the ground, to a rigid column or to a self-moving structure.

25

The upper portion of the lower element 3 is connected to the upper element 2, which is likewise of substantially tubular shape. These elements are mutually joint with suitable connection means, so as to allow relative rotation of the upper element 2 with respect to the lower fixed element 3 around a  
30 substantially vertical axis V, common to both elements.



The upper element 2 is connected to an elbow joint 4, to which a nozzle producing the jet, not shown in the drawings, is generally connected. In turn, suitable means for drawing kinetic energy, of known type, may be provided to impart to the nozzle, and consequently to its upper element 2, a cyclic rotation, about the axis V, over a complete turn or only by a circular sector.

The two elements 2 and 3 forming the body of the joint are advantageously made of particularly light material, suitably selected to reduce the weight of the assembly and to produce the necessary resistance to forces generated during use by the pressurised liquid.

The upper element 2, which functions also as joint cover, is so shaped to reduce to a minimum infiltration from the outside of water splitting during irrigation or which is splashed backward by the nozzle propulsion system.

The upper element 2 is advantageously made of two portions 2' and 2" reciprocally coupled by means of screws 5 so as to facilitate access to the joint 1 and to allow an easy maintenance, repair or substitution of the various components subject to wear.

According to the invention, the pivot connection means between the upper element 2 and the lower one 3 is constituted by a substantially cylindrical tubular element 6, having a substantially constant outer diameter and a longitudinal axis V.

Thus, the connecting tubular element 6 will allow rotation of the movable element 2 with respect to fixed element 3 about the common axis V, while allowing limited axial relative movement of these elements 2, 3, so as to allow the transmission of reaction forces generated by the jet and acting in a substantially vertical plane passing through the rotation axis V.

Advantageously, the connecting tubular element 6 may be obtained by cutting a piece of appropriate length from an indefinite pipe. Still more advantageously, such indefinite pipe can be chosen between those normally available on the market, with diameter of appropriate dimensions and with appropriate surface finishing adapted to ensure low coupling tolerance. Thus, it will be possible to reduce the production costs of this important component.

Preferably, the connecting element 6 can be made of metal, for example stainless steel, or other materials having the same mechanical strength, resistance to oxidation and corrosion, such as composite or ceramic materials.

In a first embodiment, the element 6 is rigidly attached to the upper element 2 of the joint 1. The attachment can be made by gluing, pressing, welding, immersion, threading or any other similar means, depending on the materials of which are made the pieces to be reciprocally coupled. To improve anchoring and ensure a stable coupling with element 2, the outer surface of the connection element 6 can be provided with surface discontinuities, such as e.g. grooves, annular and/or radial notches 7, or other similar shapes.

A bushing or bearing 8 in antifriction material, for example plastic material with low friction coefficient and high resistance to compression, is located between the body of the fixed element 3 and the connecting tubular element 6. The bushing or bearing 8 has narrow tolerances with respect to element 6 to allow free rotation thereof, though ensuring sufficient tightness between the two elements 2, 3.

In turn, the bearing 8 is fixedly secured to a sleeve 9 having a radially outwardly extending flange 10. The sleeve 9 is in turn anchored to the lower element 3 of the joint by means of a ring 11 fixed by screws or bolts 12.

A first lip gasket 13 is interposed between elements 2, 3 to avoid seepage between the two elements, which would produce pressure losses with reduction of liquid distribution efficiency. Moreover, as the irrigation liquid is generally mixed with dirt, the infiltration of such dirt between the bearing 8 and the connecting element 6 in the long run causes scratches or notches both on the internal surface of the bearing 8 and on the outer surface of the element 6. This would involve a quicker consumption of the components, with an increase of costs and high seizure risk between the parts in relative movement, with consequent blocking of the rotating part.

In addition to the first gasket 13, a second gasket 14 may be provided to avoid infiltration of liquid, dust cloud, sand or other impurity in the interstices between bearing 8 and pipe 6, neither from the outside nor from the inside of the joint.

Two flat rings 15 and 16 made of material of greater hardness than that of the material of the sleeve 8, preferably stainless steel, are fixed on flange 10. One of the rings, in particular the ring 15 is fixed to the upper surface of the flange 10, the other ring 16 is fixed to the lower surface of the flange 10.

Rings 15 and 16 define contact surfaces for corresponding pads 17 and 18 and constitute with the latter braking means for adjusting the rotation speed of the irrigation nozzle. Pads 17 and 18 operate like normal disk brakes both when the liquid pressure is high and when the pressure is low.

As mentioned above, the upper element 2 can axially shift by a limited distance with respect to the lower element 3, so as to force upward the pad 18 when the water is pressurised, and to act by gravity on the pad 17 when the liquid pressure in the irrigation duct drops to a minimal level.

Pads 17 and 18 are suitably made of high resistance plastic material and can extend along a whole circumference to form a unitary ring.

As an alternative, they can be shaped as separate annular segments. Pads 17 and 18 are constantly kept in contact with rings 15 and 16 by suitable elastic means, such as e.g. compression springs 19 or equivalent means.

In the alternative embodiment of the joint shown in the Fig. 3, the elements equivalent to those of figures 1 to 3 have been identified with the same reference numerals. In such alternative embodiment, the position of the contact rings 20 and 21 and pads 22 and 23 is inverted. In other words, the pads 22, 23 act against the opposite surfaces of the flange 10 and are urged against the same by springs placed in corresponding seats made in the flange, not shown in the figure.

The Fig. 4 shows another embodiment of the joint according to the invention, in which the connecting tubular element 25 is fixedly secured to the lower element 3 and remains stationary during rotation of the irrigation nozzle, while the upper element 2 rotates with respect to the elements 3 and 25 fixed to each other.

On the contrary, the sleeve 26 and the bearing or bushing 27 are jointly anchored to the upper element 2 and turn also with respect to the lower element 3.

Also in this second embodiment it is possible to provide two alternate arrangements of the braking means. In the first arrangement, illustrated in Fig. 5, the pads 22 and 23 are driven into rotation by the flange 10, while the respective metal contact discs 20 and 21 are joined to corresponding surfaces of the upper element 2. Such arrangement corresponds to that with the

braking means already shown and disclosed in Fig. 3.

The second arrangement of the braking means, schematically depicted in Fig. 6, corresponds to the arrangement with the braking pads equivalent to that already visible in Fig. 1 and 2, in which the pads 17, 18 are driven in rotation by the upper element 2 of the joint and act against the rings 15, 16 fixedly joined to the upper and lower surfaces of the flange 10.

In the embodiment of the joint according to the invention shown in Fig. 7, elements similar to those of the embodiments already described in the previous figures have been identified with the same reference numerals. In this embodiment, which has a structure similar to that of Fig. 1 and 2, the connecting tubular element 6 is jointly secured to the fixed lower element 3 by suitable securing means.

Two rings 28 and 29 having supporting function for the element 2 are placed around the upper rotating element 2. These rings act as friction bearings and for this reason are made of low friction material, for example plastic, with high structural resistance and low friction factor. Such bearings maintain the rotating element 2 in the right position with respect to the fixed element 3 and allow its rotation under the action of the torque produced by the jet of liquid flowing out from the nozzle.

Rings 28, 29 have a substantially L-shaped cross section, with shorter sides 28', 29' and longer sides 28'', 29''. The shorter sides 28', 29' are substantially planar and perpendicular to the rotation axis V and they act as guides for element 2. The longer sides 28'' and 29'' define cylindrical friction surfaces acting against the internal surface of the connecting tubular element 25. Also in this embodiment the gasket 13, for example of the lip type, ensures perfect water tightness of the joint.

It is observed that in all the embodiments described heretofore the flange 10 can be provided with lightening grooves of various shapes, and made of a lighter material than that of elements 6, 25. In fact in the embodiments of joint according to the invention, the forces acting on the sleeve are smaller than those acting on the connection element 6, 25, which must instead support strong bending moments.

Fig. 8 shows a further alternative embodiment of the joint according to the invention, in which the tubular connecting element 6 is unitarily secured to the upper element 2 of the joint and rotates together with the latter with respect to the fixed lower element 3.

A peculiarity of this latter embodiment is that the tubular connecting element 6 has a rather big length and low thickness as compared with the former embodiments.

An outer sleeve 30 is fixedly secured to the lower element 3 by means of screws 12. In the sleeve there can be recognised an essentially cylindrical central portion 30' connected to axial end portions 30'', 30''' with outer diameters larger than those of the central portion 30'.

Inside the end portions 30'', 30''', there are placed respective pads 31, 32, made of plastic material or similar, having axial protrusions 33, 34 engaging with corresponding seats 35, 36 made in the portions 30'', 30'''.

Pads 31 and 32 have substantially planar annular portions 31', 32' acting against the facing surfaces of rings 20 and 21 fixedly attached to the tubular element 6, so as to exert a braking action on rings 20, 21. Pads 31, 32 are axially forced against the rings 20, 21 by compression springs or equivalent

elastic means, not shown in the figure and placed in the seats 35, 36.

5 Pads 31, 32 moreover have internal cylindrical surfaces 31", 32" acting on the external surface of the tubular element 6 to exert on it a reaction to the radial force F produced by the jet of liquid flowing from the nozzle of the irrigator. The distance between the two portions 30" and 30'" is suitably selected in such a manner that the above-mentioned reaction force F produces strong radial stresses that can be borne by a part of the rings 31 and 32. In this embodiment, the tubular connecting element 6 is provided with two  
10 connecting rings respectively referenced 37, 38 and axially mutually spaced. The connection rings 37, 38 are secured with any known means, respectively to the upper and lower end portions of the connecting element 6.

15 Particularly, the upper ring 37 is rigidly secured to the tubular element 6 in correspondence of the upper end portion by means of a metal ring 39 with conical cross section that is adapted to tighten a split ring 40, having a similar conical cross section but with inverted taper. Rings 37 and 38 define respective axial abutments for rings 20 and 21 which provide the braking surfaces.

20 Although the self-adjusting rotating joint according to the invention has been described with specific reference to the reference numerals indicated in the description and in the figures, it is obvious that such numerals are purely indicative and in no way limit the scope of invention as defined in the  
25 appended claims.

The contents of Italian patent application No. VI99A000030, for which priority is claimed, are incorporated herein by reference.

## CLAIMS

1. Self-adjusting rotating joint (1), particularly for liquid distribution devices, comprising

5 - a first substantially tubular element (3), adapted to be connected to a liquid feeding inlet pipe,

- a second substantially tubular element (2), adapted to be connected to a liquid distribution nozzle,

10 - connecting means (6, 25) adapted to pivotally connect said first (3) and second (2) elements, so as to allow their reciprocal rotation about a common axis (V), with limited axial relative displacement, thereby transferring a reaction force produced by the jet and lying on a plane passing through said common axis (V);

15 - braking means (15, 16, 17, 18, 20, 21, 22, 23, 30, 31) to counter said relative rotary motion of said elements (2, 3) about said rotation axis (V); characterised in that said connection means consist of a substantially cylindrical tubular element (6, 25) with substantially constant outer diameter.

20 2. Self-adjusting rotating joint according to claim 1, characterised in that said first tubular element (3) is stationary and said second tubular element (2) is rotating.

25 3. Self-adjusting rotating joint according to claim 2, characterised in that said connecting tubular element (6, 25) is rigidly secured to only one of said elements (3, 2).

4. Self-adjusting rotating joint according to claim 3, characterised in that said connecting tubular element (6, 25) consists of a section of an indefinite pipe of predetermined length.



5. Self-adjusting rotating joint according to claim 4, characterised in that said tubular element (6) is fixedly attached to said second element (2) to rotate therewith about said common axis (V).

5 6. Self-adjusting rotating joint according to claim 5, characterised by the fact that it includes a sleeve (9) of substantially cylindrical shape rigidly fixed peripherally to said first element (3) and provided with a flange (10) interacting with said braking means to controllably counter the rotation of the moving element (2) of the joint (1).

10 7. Self-adjusting rotating joint according to claim 5, characterised by the fact that it includes a sleeve (30) of substantially cylindrical form rigidly attached to an end portion of said first fixed element (3) and placed peripherally to said connecting tubular element (6), said sleeve (30) having a  
15 portion (30') of substantially tubular form joined to axial end portions (30'', 30''') adapted to house substantially annular corresponding pads (30, 31).

8. Rotating joint according to claim 7, characterised in that said annular pads (31, 32) have internal cylindrical surfaces (31'', 32''), in friction contact  
20 with said tubular element (6) to transfer the reaction to the force (F) generated by the jet in an axial plane passing through said common axis (V), and planer annular surfaces (31', 32') acting on braking surfaces (20, 21) joint with said mobile tubular element (2) to controllably counter its rotation with respect to said fixed tubular element (3).

25 9. Self-adjusting rotating joint according to claim 4, characterised in that said tubular element (25) is unitarily fixed to said stationary tubular element (3).

30 10. Self-adjusting rotating joint according to claim 9, characterised by

the fact of providing a sleeve (26) of substantially cylindrical shape rigidly coupled to said second element (2) and provided with a flange (10) interacting with said braking means (20, 21) to controllably counter the rotation of the joint (2) mobile element.

5

11. Self-adjusting rotating joint according to claim 10, characterised in that respective annular elements (28, 29) are rigidly fixed to said second rotating element (2), said elements (28, 29) being axially spaced and interacting between said tubular element (25) and said mobile upper element  
10 (2) to define a friction pad and to transmit to said fixed element (3) the forces acting on said upper rotating element (2).

12. Self-adjusting rotating joint according to any of the preceding claims 6 or 11, characterised in that said sleeve (9, 26) has internally thereof at least  
15 an antifriction ring (8, 27) defining a friction bearing.

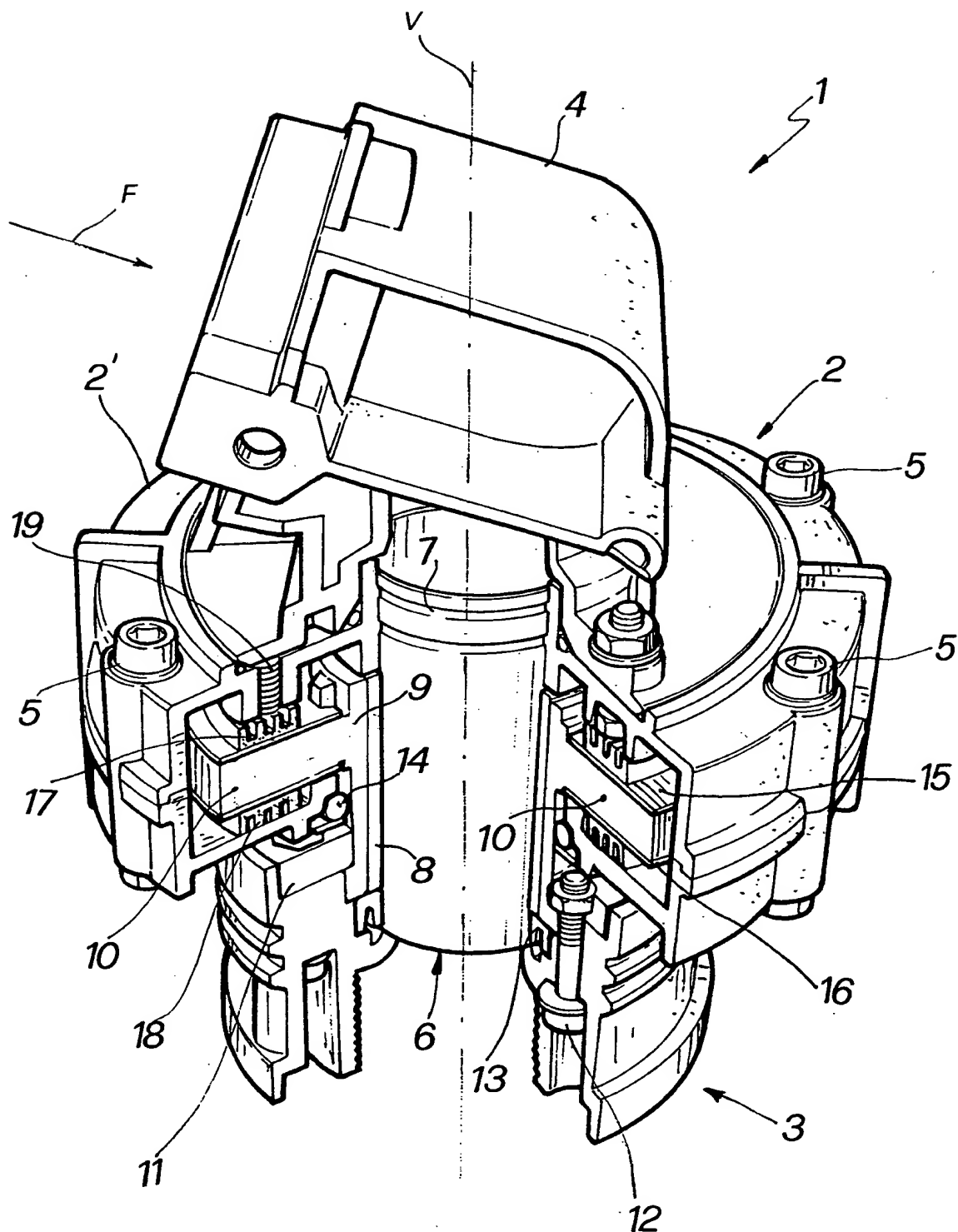
13. Self-adjusting rotating joint according to claim 12, characterised in that said braking means consist of pads (17, 18) of material with high wear resistance, adapted to interact with substantially annular braking surfaces (15,  
20 16) unitarily joined to said flange (10).

14. Self-adjusting rotating joint according to claim 12, characterised in that said braking means consist of pads (22, 23) unitarily secured to said flange (10) on opposite sides thereof and adapted to interact with braking  
25 surfaces (20, 21) defined by substantially annular elements of high wear resistance material.

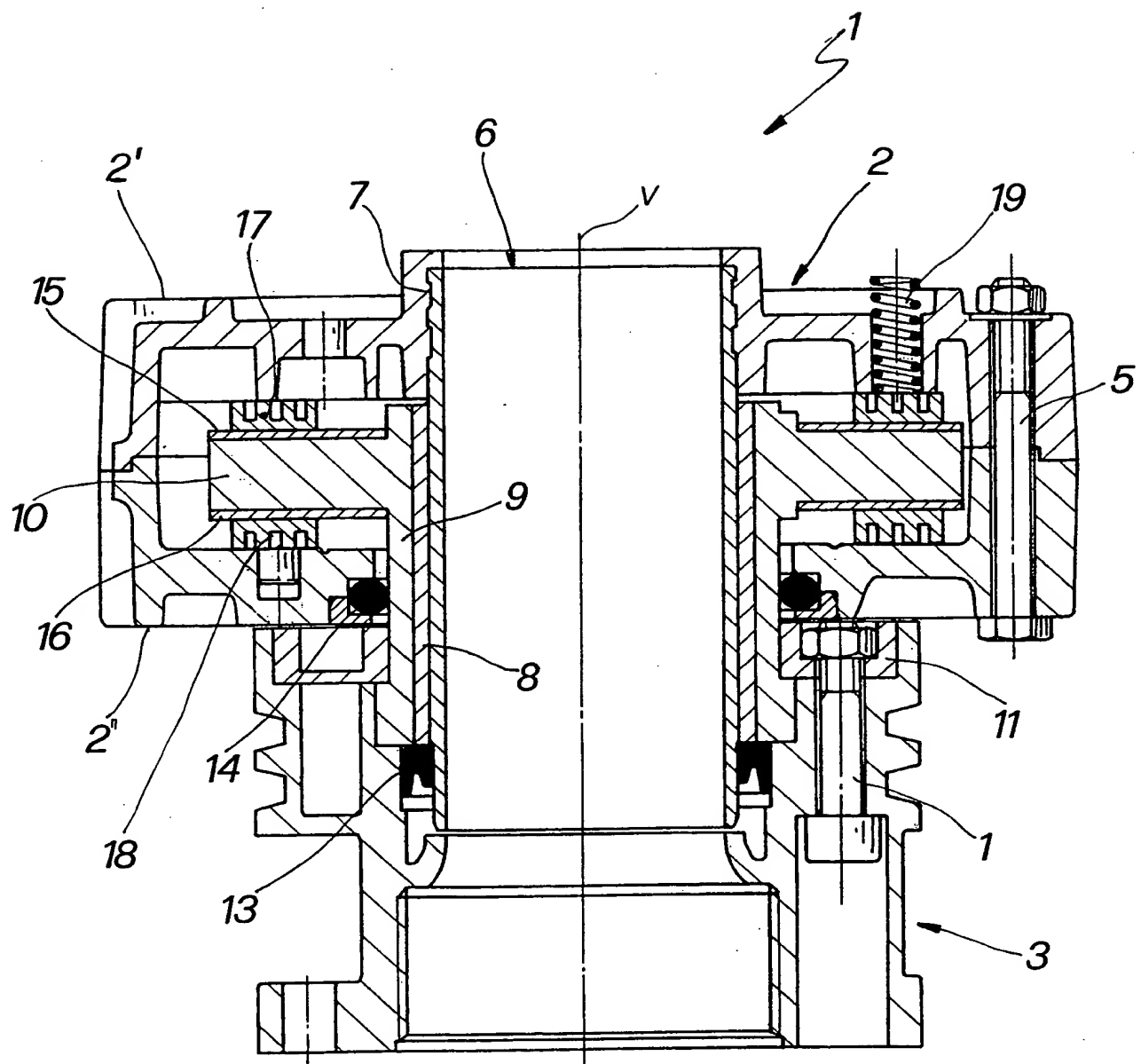
15. Self-adjusting rotating joint according to any of the claims 13 or 14, characterised in that said pads (17, 18, 22, 23, 31, 32) are shaped as  
30 continuous rings or circular sectors circumferentially spaced and placed

peripherally to said sleeve (8, 26), elastic means (19, 24) being provided to force said pads (17, 18, 22, 23, 31, 32) against said braking surfaces.

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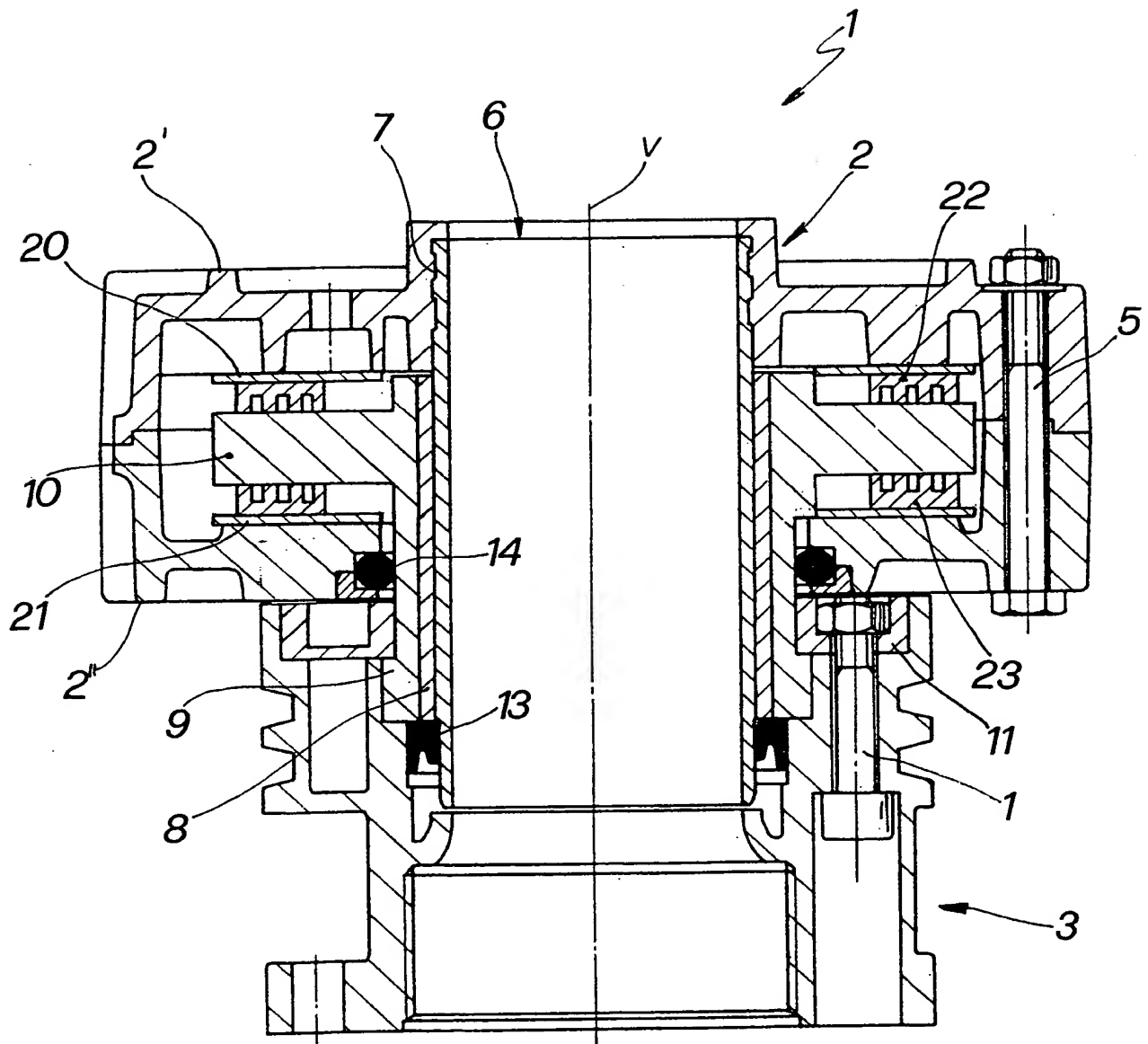
**Fig. 1**

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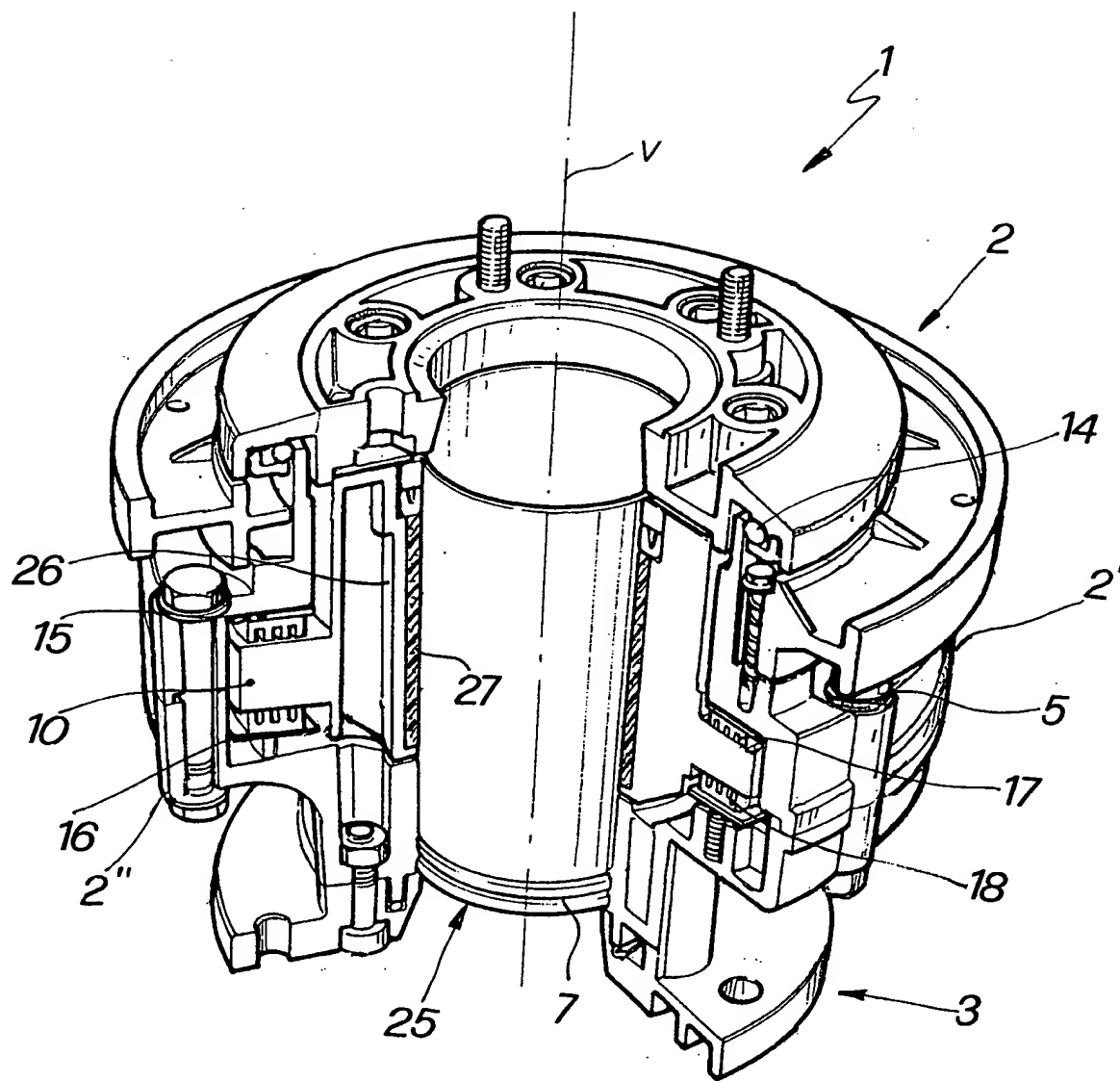


**Fig. 2**

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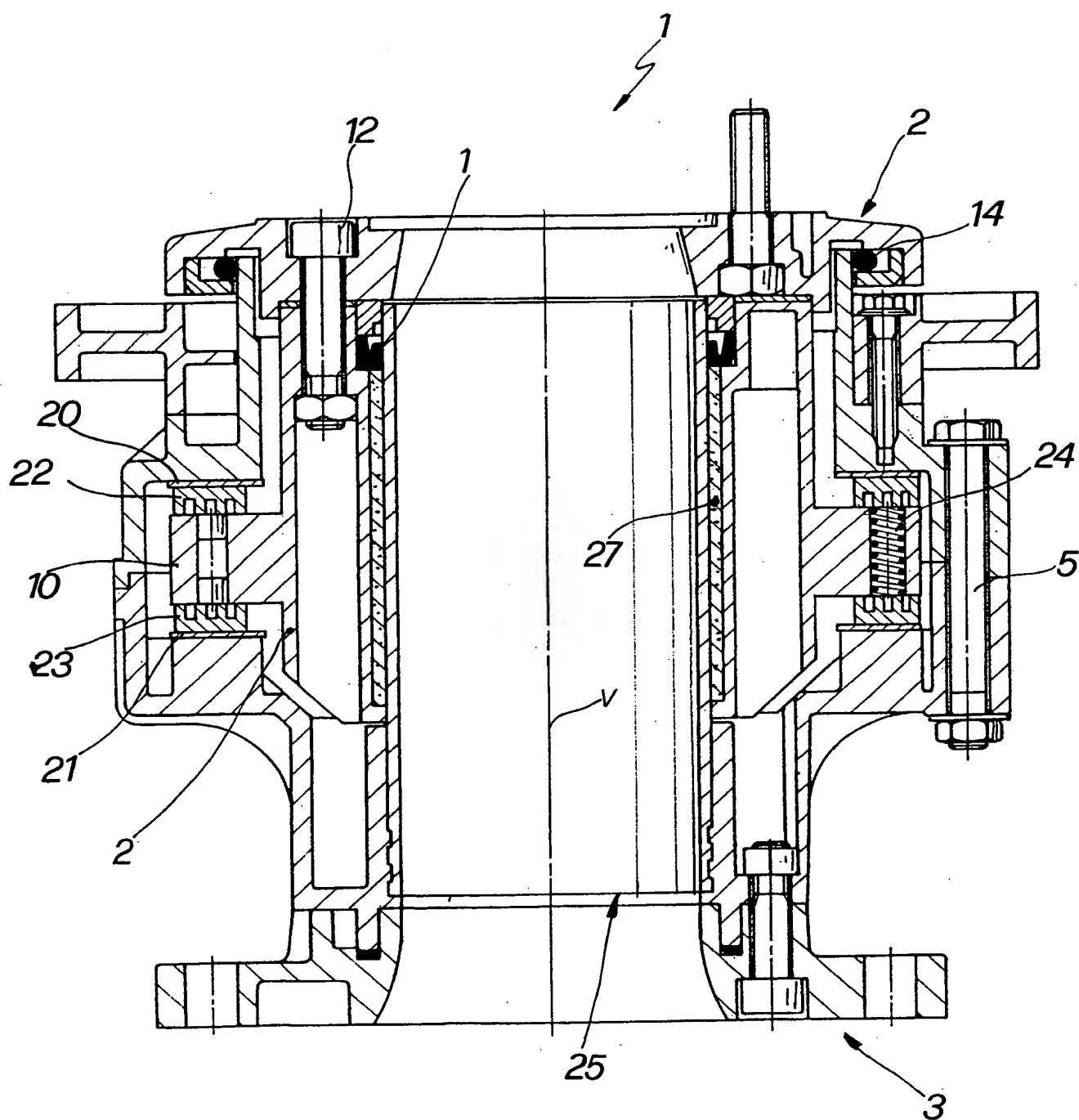
**Fig. 3**

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**Fig. 4**

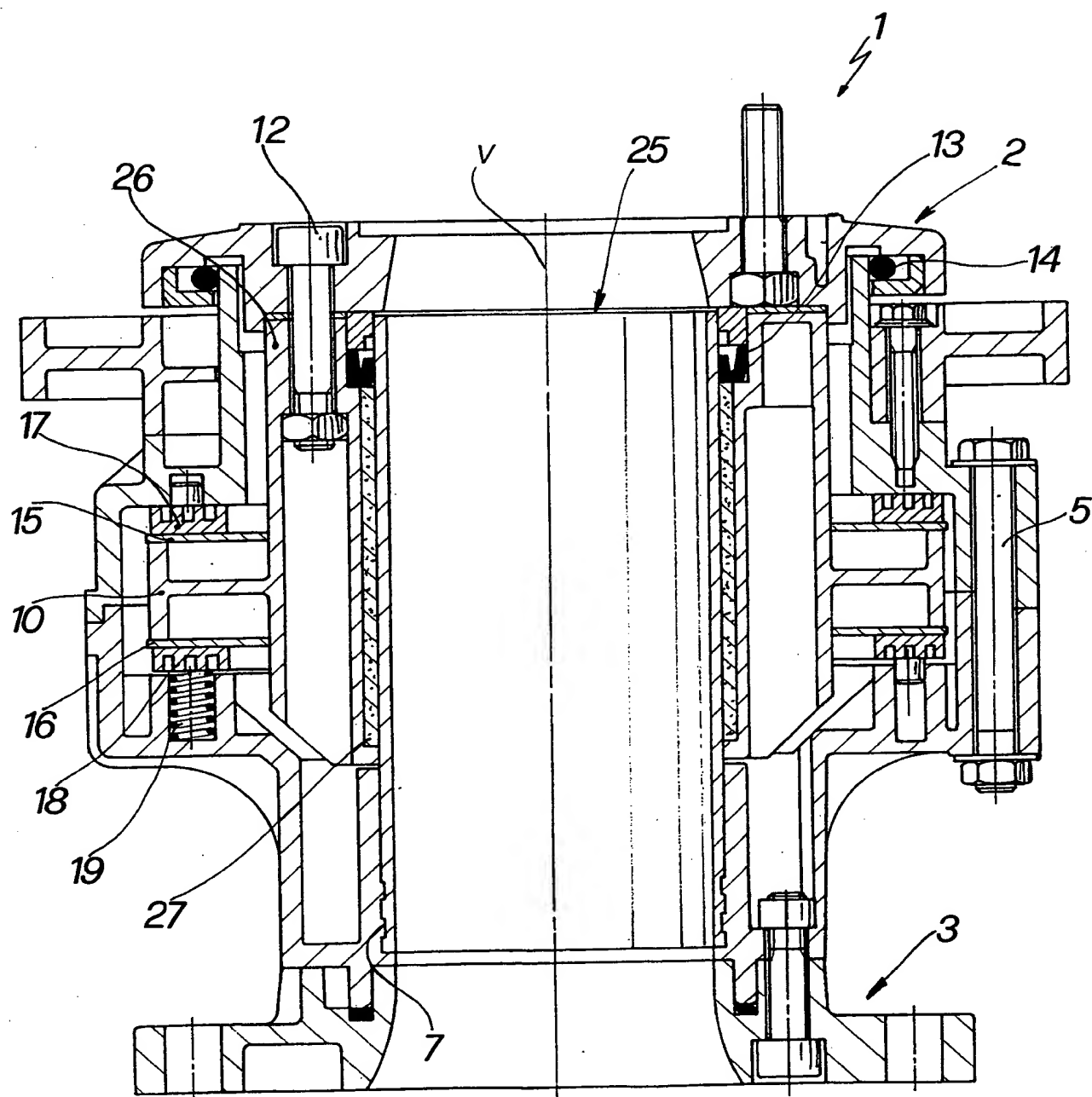
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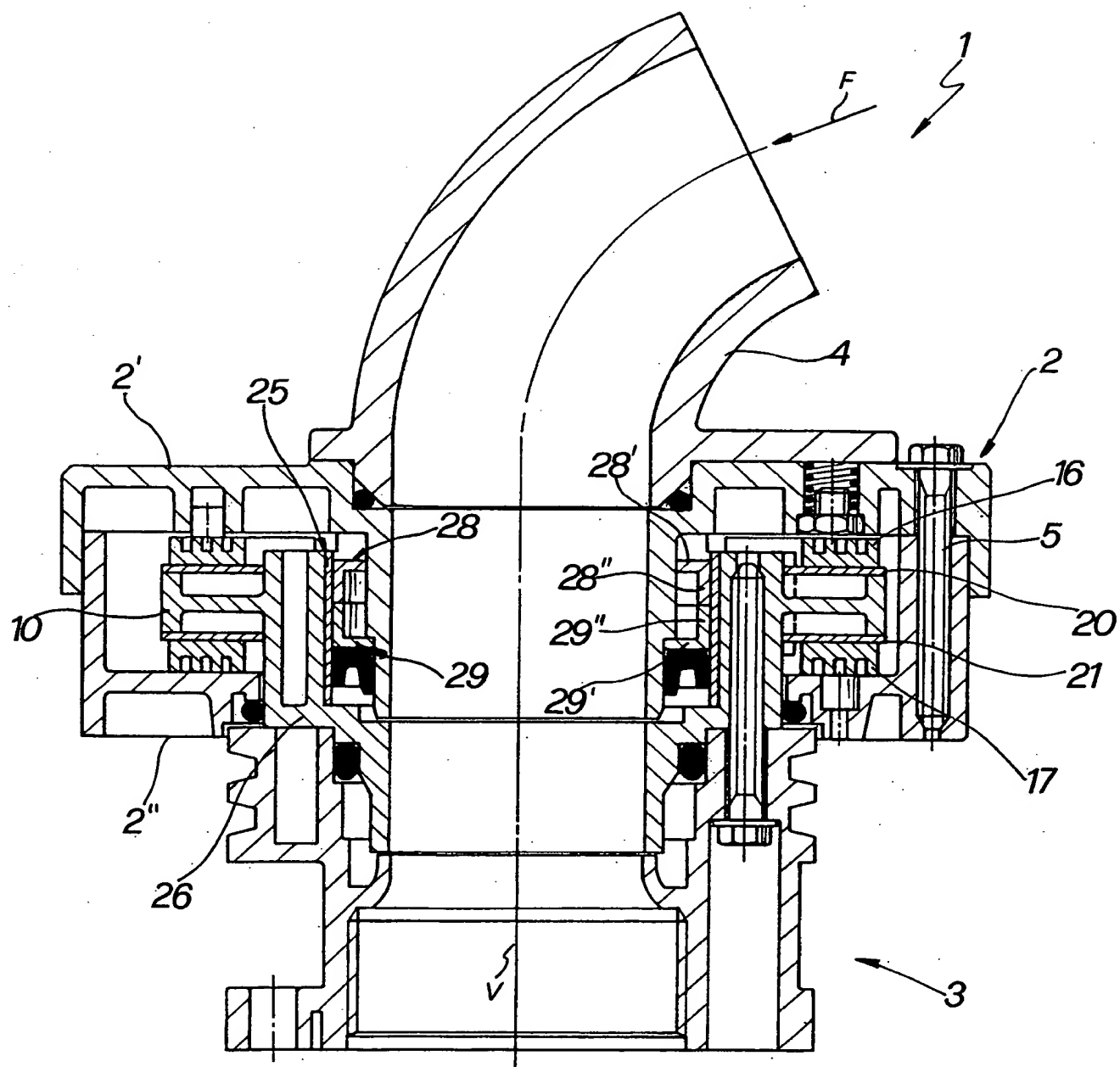
**Fig. 5**



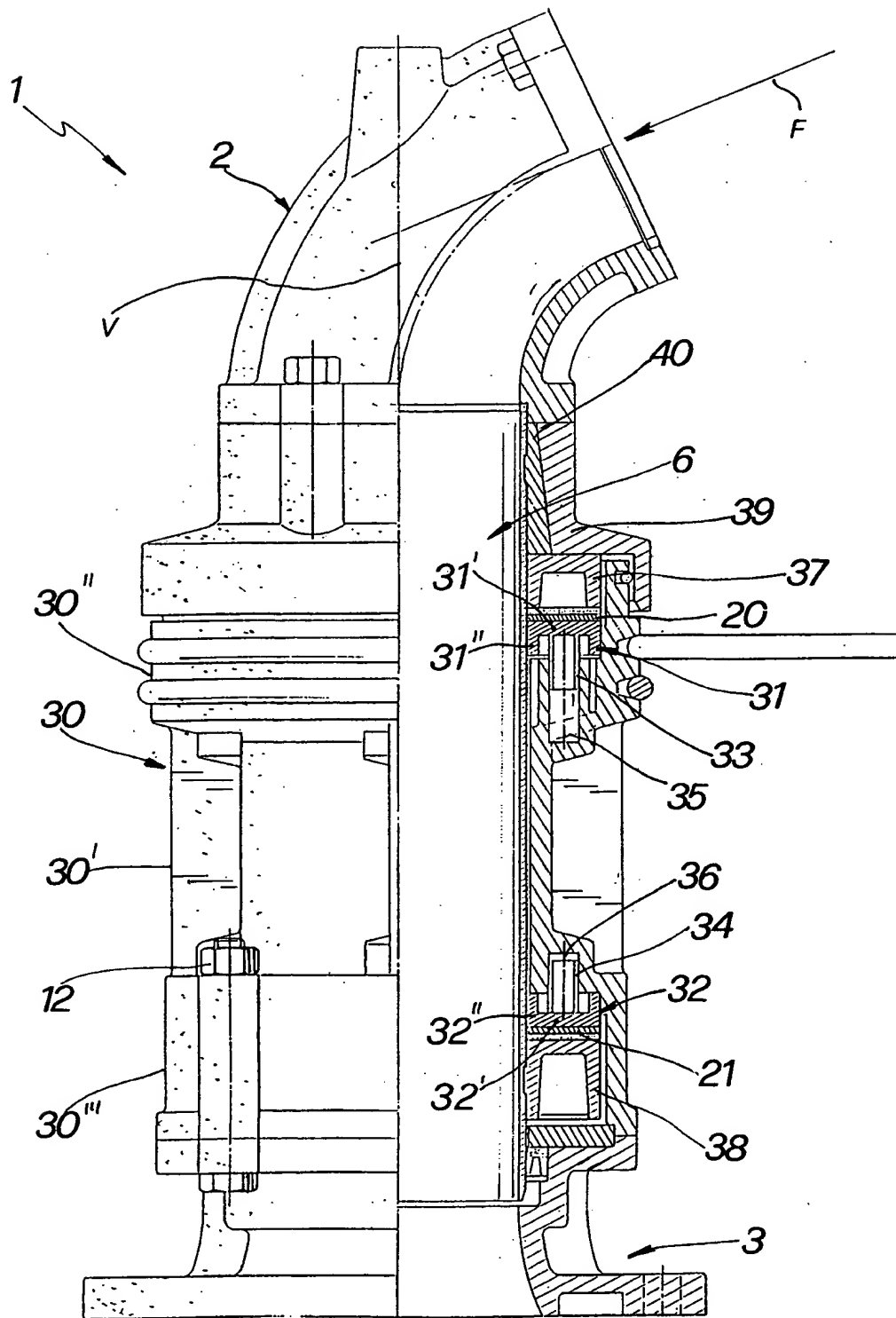
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**Fig. 6**

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**Fig. 7**

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**Fig. 8**

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 00/00162

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B05B3/04 B05B3/16 A01G25/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B05B A01G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	the whole document	6-8, 10-15
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A	page 1, column D, line 40 - line 43; figure 1	3-5,9
Y	US 4 231 522 A (DRECHSEL) 4 November 1980 (1980-11-04) cited in the application claims; figures	6-8, 10-15
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

20 June 2000

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# INTERNATIONAL SEARCH REPORT

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